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REMARKS

In response to the Office Action mailed July 24, 2006, the Applicants respectfully request reconsideration. To further the prosecution of this Application, the Applicants submit the following remarks and have added new claims. The claims as now presented are believed to be in allowable condition.

Claims 13, 15-18, 20, and 29 were pending in this Application. By this Amendment, claims 30-33 have been added. Accordingly, claims 13, 15-18, 20, 29, and 30-33 are now pending in this Application. Claim 13 is an independent claim.

Examiner Interview Summary

On November 6, 2006, the Applicants' Representative, Jeffrey J. Duquette, conducted an Examiner Interview with Examiner Brian Kunzer. Attorney Duquette wishes to thank Examiner Kunzer for his time and consideration. During the interview, claims 13 and 29 were discussed. However, no agreement was reached as to the allowability of the claims.

Rejections under 35 U.S.C. §101 and 35 U.S.C. §112, second paragraph

The Office Action has rejected claims 13, 15-18, 20, and 29 under 35 U.S.C. §101 and has asserted that the limitations are simultaneously drawn to a process and a manufacture which is not a patentable invention. The Office Action has also rejected claims 13, 15-18, 20, and 29 under 35 U.S.C. §112, second paragraph as being indefinite for failing to distinctly claim the subject matter which the Applicant regards as his invention. The Applicants respectfully request reconsideration of these rejections.

A. Rejection of claims 13 and 29 under 35 U.S.C. §101

With respect to the rejection of claims 13 and 29 under 35 U.S.C. §101, the Office Action has recited Ex parte Pfeiffer, 135 USPQ 31, 1962 C.D. 408

(1961) and has indicated on page 5, paragraph 3 that "to be entitled to weight in method claims, the recited-structure limitations therein must affect the method in a manipulative sense, and not amount to a mere claiming of a use of a particular structure." Assuming that the Office Action has properly interpreted and relied upon the cited legal authority, the Applicants believe the rejection of claims 13 and 29 under 35 U.S.C. §101 to be improper because the limitations recited in claims 13 and 29 do affect the claimed method in a manipulative sense.

Claim 13 relates to a method for manufacturing an area array package and recites, in part, "coupling a series of secondary electrical contacts to the coupling surface of the substrate within a peripheral area defined by the coupling surface, the series of secondary electrical contacts configured to carry power signals between the area array package and the circuit board, the series of secondary electrical contacts separate from the grid array." With respect to the rejection of claim 13 under 35 U.S.C. §101, the Office Action asserts, on page 4, first paragraph, that the following elements of claim 13:

- the substrate having at least one power plane, at least one ground plane, at least one plated through hole in communication with the at least one power plane, and at least one plated through hole in communication with the ground plane;

- the substrate having a contact pad in electrical communication with the at least one plated through hole in communication with the at least one power plane and electrically coupled with a secondary solder ball of the series of secondary electrical contacts;

- the substrate having a contact pad in electrical communication with the at least one plated through hole in communication with the at least one ground plane and electrically coupled with a secondary solder ball of the series of secondary electrical contacts;

- the secondary solder ball, contact pad, and the at least one plated through hole in communication with the at least one power plane configured to carry power to the at least one power plane through the coupling surface; and

- the secondary solder ball, contact pad, and the at least one plated through hole in communication with the at least one ground

plane configured to carry power from the at least one ground plane through the coupling surface

are drawn to a product and constitute mere structural limitations that do not affect the process of making in a manipulative sense.

The Applicants submit that the structure of the substrate, namely the power plane, ground plane, plated through holes, and contact pads as recited in claim 13, affects the method of manufacturing the area array package. For example, the structure of the substrate provides particular locations, i.e., contact pads, where the manufacturer couples the secondary electrical contacts to the coupling surface of the substrate. Additionally, the configuration of the substrate (i.e., the substrate's contact pads in electrical communication with the power plane via the corresponding plated through holes and the substrate's contact pads in electrical communication with the ground plane via the corresponding plated through holes), allows the manufacturer to configure the series of electrical contacts to carry power signals between the area array package and the circuit board. For example, as the manufacturer couples the secondary electrical contacts to the contact pads in electrical communication with the power plane via the corresponding plated through holes and to the contact pads in electrical communication with the ground plane via the corresponding plated through holes, such coupling configures the secondary electrical contacts to carry power signals between the area array package and the circuit board. Therefore, the configuration of the substrate, as claimed, affects the method of manufacturing the area array package and reconsideration of the rejection of claim 13 under 35 U.S.C. §101 is respectfully requested.

Claim 29 depends from claim 13 and recites, in part:

surface mounting a die to a second surface of the substrate, the second surface of the substrate opposing the coupling surface of

the substrate, to electrically couple the die with the first set of contact pads and the second set of contact pads.

With respect to the rejection of claim 29 under 35 U.S.C. §101, the Office Action asserts, on page 4, first paragraph, that the recitation of

wherein the die is configured to exchange, through second surface of the substrate, at least data signals with the circuit board through the grid array of primary electrical contacts and wherein the die is configured to exchange, through second surface of the substrate, power signals with the circuit board via the at least one secondary solder ball, the at least one contact pad, and the at least one plated through hole

in claim 29 is drawn to a product and constitutes mere structural limitations that do not affect the process of making in a manipulative sense. However, the Applicants submit that the configuration of the die affects the process of manufacturing the area array package.

For example, as recited in the claim, the die is configured to exchange “at least data signals with the circuit board through the grid array of primary electrical contacts” and is configured to exchange “power signals with the circuit board via the at least one secondary solder ball, the at least one contact pad, and the at least one plated through hole.” However, in order to provide for the die to properly exchange data signals and power signals with the circuit board, the manufacturer surface mounts the die to the second surface of the substrate in a particular manner. For example, when surface mounting the die, the manufacturer positions the die on the second surface of the substrate such that contacts associated with the die electrically couple to the grid array of primary electrical contacts and to the secondary solder balls in a manner that allows the die to function properly (i.e., to exchange “at least data signals with the circuit board through the grid array of primary electrical contacts” and to exchange “power signals with the circuit board via the at least one secondary solder ball, the at least one contact pad, and the at least one plated through hole”) during

operation. Therefore, when the manufacturer surface mounts the die to the second surface of the substrate, the manufacturer performs such surface mounting in a particular manner based upon the configuration of the die. Therefore, the configuration of the die, as claimed, affects the method of manufacturing the area array package and reconsideration of the rejection of claim 29 under 35 U.S.C. §101 is respectfully requested.

B. Rejection of claims 13 and 29 under 35 U.S.C. §112, second paragraph

With respect to the rejection of claims 13 and 29 under 35 U.S.C. §112, second paragraph, on page 6, item 4, the Office Action recites that claims 13 and 29 are ambiguous in that they contain structural limitations and do not define a patentable invention. The Office Action cites Ex parte Lyell, 17 U.S.P.Q.2d 1548 (Bd. Pat. App. & Inter. 1990) as legal authority to support the rejection of claims 13 and 29 under 35 U.S.C. §112, second paragraph. As indicated in the MPEP § 2173.05(q), citing Ex parte Lyell, "a single claim which claims both an apparatus and the method steps of using the apparatus is indefinite under 35 U.S.C. 112, second paragraph." However, assuming that the Office Action has properly interpreted and relied upon the cited legal authority, the Applicants respectfully submit that the Office Action has misapplied Ex parte Lyell in this case.

In Ex parte Lyell, the patent application under review by the Board of Patent Appeals and Interferences related to a transmission repair tool in the form of a workstand and to the method of using same in repairing automatic transmissions. The claim of concern, claim 2 as presented below:

2. An automatic transmission tool in the form of a workstand and method for using same comprising:

a support means,

and [sic] internally splined sleeve affixed upright to said support means,

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a threaded adjustment bolt threadably engaged through a hole in the bottom of said support means and projecting upward through said support frame into said sleeve,

and further comprising the steps of

1. positioning the output end of an automatic transmission onto said upright sleeve,
2. removing the internal components of said automatic transmission from the casing of said transmission,
3. repairing and replacing said internal components back into said casing, and
4. adjusting said internal components for fit and interference by means of adjusting said upwardly projecting adjustment bolt.

As such, claim 2 of Ex parte Lyell relates to two separate statutory classes of subject matter: “an automatic transmission tool in the form of a workstation” and a “method for using the same.” By contrast, claims 13 and 29 clearly relate to a single statutory class of subject matter i.e., a method for manufacturing an area array package. While the method for manufacturing recited in claims 13 and 29 uses particular elements having particular configurations, these elements affect the process of manufacturing the area array package as recited above and do not constitute separate statutory classes of subject matter. As such, claims 13 and 29 are definite and do not fall under the type of claims precluded by Ex parte Lyell. Reconsideration of the rejection of claims 13 and 29 under 35 U.S.C. §112, second paragraph is respectfully requested.

Rejections under §102 and §103

Claims 13, 15, 18, 20, and 29 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,627,822 to Jackson (hereinafter Jackson) in view of U.S. Patent No. 6,736,306 to Byun (hereinafter Byun). Claims 16 was rejected under 35 U.S.C. §103(a) as being unpatentable over

Jackson in view of in view of Byun and further in view of U.S. Patent No. 6,600,220 to Barber. Claim 17 was rejected under 35 U.S.C. §103(a) as being unpatentable over Jackson in view of in view of Byun and further in view of U.S. Patent No. 6,787,920 to Amir. The Applicants respectfully traverse the rejections and request reconsideration. The claims are in allowable condition.

Independent claim 13 was rejected under 35 U.S.C. §103(a) as being unpatentable over Jackson in view of Byun. Claim 13 relates to a method for manufacturing an area array package. The method comprises coupling a grid array of primary electrical contacts to a coupling surface of a substrate within a central portion defined by the substrate, the grid array of primary electrical contacts configured to carry at least data signals between the area array package and a circuit board. The method comprises forming the primary electrical contacts of the grid array as a plurality of primary solder balls, each primary solder ball of the grid array defining a first diameter. The method also comprises coupling a series of secondary electrical contacts to the coupling surface of the substrate within a peripheral area defined by the coupling surface, the series of secondary electrical contacts configured to carry power signals between the area array package and the circuit board, the series of secondary electrical contacts separate from the grid array. The method also comprises forming the series of secondary electrical contacts as a plurality of secondary solder balls, each secondary solder ball of the series defining a second diameter, the second diameter defined by each of the secondary solder balls being greater than the first diameter defined by each of the primary solder balls. Coupling the series of secondary electrical contacts comprises coupling the series of secondary electrical contacts to the coupling surface of the substrate, the coupling surface configured to oppose a mounting surface of the circuit board, the substrate having at least one power plane, at least one ground plane, at least one plated through hole in communication with the at least one power plane, and at least one plated through hole in communication with the ground plane. The

substrate has a contact pad in electrical communication with the at least one plated through hole in communication with the at least one power plane and electrically coupled with a secondary solder ball of the series of secondary electrical contacts. The substrate has a contact pad in electrical communication with the at least one plated through hole in communication with the at least one ground plane and electrically coupled with a secondary solder ball of the series of secondary electrical contacts. The secondary solder ball, contact pad, and the at least one plated through hole is in communication with the at least one power plane configured to carry power to the at least one power plane through the coupling surface. The secondary solder ball, contact pad, and the at least one plated through hole is in communication with the at least one ground plane configured to carry power from the at least one ground plane through the coupling surface.

Jackson generally relates to an electronic assembly with separate power and signal connectors. In particular, the electronic assembly in Jackson includes a substrate, such as a semiconductor chip or a socket to hold a semiconductor chip, having a multiplicity of solder balls. Each solder ball can be melted to form a signal connection with corresponding conductive pads of a printed circuit board. The electronic assembly also includes a plurality of pins that electrically connect with holes formed in the printed circuit board to form power connections between the substrate and the circuit board.

Byun generally relates to a semiconductor chip package configured to prevent cracks from forming between external connection terminals, such as solder balls and ball pads. In Byun, a board-mounted BGA package 200 includes a chip 110 mounted on a substrate 120 and enhanced pads 170 formed at the outer edges of the bottom surface of the substrate 120. Each of the enhanced pads 170 includes a ball pad 124, at least one dummy pad 174, and a dummy pattern 172 that connects the ball pad 124 to the dummy pad 174. In

Byun, when mounting the BGA package to a board 150 using the enhanced pads 170, solder balls 160 are formed on both the ball pads 124 and the dummy pads 174 of the substrate 120. The solder balls 160 then undergo a solder reflow process to form a connection terminal 162 over an entire area of the enhanced pad. Regarding the connection terminal, Byun recites that:

[s]ince a single connection terminal is formed using the whole area of the enhanced pad (including the ball pad, the dummy pads, and the dummy patterns), this preferred method of the present invention effectively improves the reliability of the solder joint. Moreover, in this embodiment, most of the dummy patterns are arranged parallel to the long side of the substrate, along which cracks mainly occur, thereby more effectively preventing cracks. Thus, the foregoing embodiments of the present invention improve the reliability of the package mounting. Column 5, lines 23-32.

In order to establish a *prima facie* case of obviousness, the Office Action must meet three criteria.

“First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.”¹

As indicated above, independent claim 13 was rejected under 35 U.S.C. §103(a) as being unpatentable over Jackson in view of in view of Byun. However, claim 13 is patentable over Jackson in view of in view of Byun because the Office Action’s proposed modification to Jackson, via the teachings of Byun, renders Jackson unsatisfactory for its intended purpose.

Jackson teaches the use of an electronic assembly having separate elements that form signal connections and power connections with a circuit board. The electronic assembly of Jackson includes a multiplicity of solder balls

¹ *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

that form signal connections with conductive pads of a printed circuit board and a plurality of pins that electrically connect with holes formed in the printed circuit board to form power connections between the substrate and the circuit board. By replacing the pins of Jackson with the connection terminals 162 of Byun (i.e. the solder mass disposed on the enhanced pads 170 of Byun which includes the ball pad 124, at least one dummy pad 174, and the dummy pattern 172), the combination results in an electronic assembly having solder balls that form signal connections with conductive pads of a printed circuit board and a plurality of bulky connection terminals 162 configured to form power connections between the substrate and the circuit board. However, the combination of Jackson and Byun renders Jackson unsatisfactory for its intended purpose because, with such a combination, the bulky connection terminals 162 cannot be inserted into, or electrically connected with, the holes formed in the printed circuit board to form power connections between the substrate and the circuit board. In particular, it is unclear how one would go about inserting the bulky connection terminals 162 of Byun into the holes formed in the printed circuit board of Jackson to form power connections therebetween in order to allow operation of the electronic assembly.

For the reasons stated above, claim 13 patentably distinguishes over the cited prior art, and the rejection of amended claim 13 under 35 U.S.C. §103(a) should be withdrawn. Accordingly, claim 13 is in allowable condition. Because claims 15-18, 20, and 29 depend from and further limit claim 1, claims 15-18, 20, and 29 are in allowable condition for at least the same reasons.

Additionally, it should be understood that the dependent claims recite additional features which further patentably distinguish over the cited prior art.

For example, with respect to the rejection of claim 29, on page 11, paragraph 1 the Office Action asserts that Jackson teaches "surface mounting a

die (chip) to a second surface of the substrate (socket), the second surface of the substrate (socket) opposing the coupling surface of the substrate, to inherently electrically couple the die (chip) with the first set of contact pads and the second set of contact pads.”

Jackson generally relates to an electronic assembly with separate power and signal connectors. In particular, the electronic assembly in Jackson includes a substrate 108, such as a semiconductor chip or a socket to hold a semiconductor chip, having a multiplicity of solder balls 114. Each solder ball 114 can be melted to form a signal connection with corresponding conductive pads of a printed circuit board 101. The electronic assembly also includes a plurality of pins 110 that electrically connect with holes formed in the printed circuit board to form power connections between the substrate and the circuit board.

While Jackson does recite the second substrate 108 as being a socket to hold a semiconductor chip, there is no teaching or suggestion in Jackson of “surface mounting a die (i.e., the chip of Jackson) to a second surface of the substrate (i.e., the socket of Jackson),” such as claimed by the Applicants. A surface mount die includes an array of solder balls that, during manufacture, contact an array of contact pads and that undergo a solder reflow process to electrically couple the die to the pads. Jackson does not specifically teach or disclose surface mounting (e.g., use of surface mount technology to electrically couple) the chip to the socket. Additionally, it is unclear why one of ordinary skill in the art would surface mount a die to a socket, as suggested by the Office Action.

Because neither Jackson nor Byun teaches or suggests “surface mounting a die to a second surface of the substrate, the second surface of the substrate opposing the coupling surface of the substrate, to electrically couple the die with

the first set of contact pads and the second set of contact pads” as claimed by the Applicants, claim 29 patentably distinguishes over Jackson nor Byun and the rejection of claim 29 under 35 U.S.C. §103(a) should be withdrawn.

Newly Added Claims

Claims 30-33 have been added and are believed to be in allowable condition. Claims 30-33 depend from claim 13. Support for claims 30 and 32 is provided within the Specification, for example, on page 10, line 28 through page 11, line 8 and on page 13, line 26 through page 14, line 12. Support for claim 31 is provided within the Specification, for example, on page 10, lines 14-22. Support for claim 33 is provided within the Specification, for example, on page 13, lines 13-25. No new matter has been added.

The newly added claims further distinguish from the cited prior art.

For example, claim 30 recites, in part, “forming the substrate having a length that is substantially equal to 60 mm and having a width that is substantially equal to 60 mm,” “coupling the grid array of primary electrical contacts to the coupling surface of the substrate in an array pattern of 50 columns having 50 primary electrical contacts per column within the central portion defined by the substrate,” and “coupling the series of secondary electrical contacts to the coupling surface of the substrate ... a sum of the primary electrical contacts and the secondary electrical contacts being greater than 2500 electrical contacts.”

The Office Action recites on page 10, with respect to the rejection of claim 18 that “mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.” In the case of claim 30, the width and length of the substrate, as well as the sum of the primary electrical contacts

and the secondary electrical contacts being greater than 2500 electrical contacts are for a particular unobvious purpose, as recited in the Specification as filed.

With respect to the claim's recitation of "forming the substrate having a length that is greater than 45 mm and having a width that is greater than mm", the Specification recites:

Substrates of conventional area array packages have lengths of approximately 45 mm and widths of approximately 45 mm. In the area array package 24, as shown in Fig. 2, the length 64 and width 66 of the substrate 26 are relatively larger than the lengths and widths of substrates of conventional area array packages. In one arrangement, the length 64 defined by the substrate is approximately 60 mm and the width 66 defined by the substrate is approximately 60 mm. ... ***The additional length 64 and width 66 of the substrate 26, compared to conventional area array package substrates, provide a location for a manufacturer to secure the additional series 52 of secondary electrical contacts 54 to the area array package 24, thereby increasing the amount of power received by the area array package 24 while maintaining the number of primary electrical contacts 50 of the grid array 48 configured to carry data signals.*** Page 13, line 26 through page 14 line 12, emphasis added.

Therefore, the purpose of forming the substrate having a length and a width that are greater than 45 mm is to allow a manufacturer to increase the amount of power received by the area array package while maintaining the number of primary electrical contacts of the grid array used to carry data signals to the area array package. As a result, such a manufacturing step helps to maintain the overall performance of the area array package (Specification page 5, lines 9-11).

With respect to the claim's recitation of "coupling the grid array of primary electrical contacts in an array pattern of 50 columns having 50 primary electrical contacts per column to the coupling surface of the substrate within the central

portion defined by the substrate” and “coupling the series of secondary electrical contacts to the coupling surface of the substrate ... a sum of the primary electrical contacts and the secondary electrical contacts being greater than 2500 electrical contacts,” the Specification recites:

the series 52 of secondary electrical contacts 54 increases a number of electrical contacts of the area array package 24, as compared to a typical number of electrical contacts located on a conventional area array package. **For example, conventional grid arrays have an array pattern of 50 columns having 50 electrical contacts (e.g., solder balls) per column.** Such an array or grid configuration (50 x 50) results in the conventional grid array having a total of 2500 electrical contacts. In the present case, assume the grid array 48 includes 2500 electrical contacts 50. ***The series 52 of secondary electrical contacts 54 provide additional electrical contacts for the area array package 24 such that the total number of electrical contacts 29 of the area array package 24 (e.g., the sum of the number primary electrical contacts 50 and the number of secondary electrical contacts 54) is greater than 2500, for example.*** Page 11, line 20 through page 12, line 9, emphasis added.

Therefore, the purpose of “coupling the grid array of primary electrical contacts in an array pattern of 50 columns having 50 primary electrical contacts per column to the coupling surface of the substrate within the central portion defined by the substrate” and “coupling the series of secondary electrical contacts to the coupling surface of the substrate ... a sum of the primary electrical contacts and the secondary electrical contacts being greater than 2500 electrical contacts” is to allow a manufacturer to increase the amount of power received by the area array package while maintaining the number of primary electrical contacts of the grid array used to carrying data signals to the area array package. As a result, such manufacturing steps help to maintain the overall performance of the area array package (Specification page 5, lines 9-11).

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Conclusion

In view of the foregoing remarks, this Application should be in condition for allowance. A Notice to this affect is respectfully requested. If the Examiner believes, after this Amendment, that the Application is not in condition for allowance, the Examiner is respectfully requested to call the Applicants' Representative at the number below.

The Applicants hereby petition for any extension of time which is required to maintain the pendency of this case. If there is a fee occasioned by this Amendment, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 50-3661.

If the enclosed papers or fees are considered incomplete, the Patent Office is respectfully requested to contact the undersigned collect at (508) 616-2900, in Westborough, Massachusetts.

Respectfully submitted,



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Attorney Docket No.: 1004-005

Dated: November 20, 2006